

# CNSeeing a Community

Just Big Enough - Green Housing for All

**Concept:**  
CNSeeing: a proposal that focuses on the development of a system for incremental housing using digital fabrication technologies (CNC milling) to develop a structural envelope derived from single sheet material (plywood). Cost, innovative fabrication methods, transportation, and the potential of employing a low skilled work force in the assembly of the structure are addressed equally in the design and construction process.

**Building Size & Configurations:**  
1 bedroom: 488 sf finished interior space  
2 bedroom: 666 sf finished interior space  
3 bedroom: 770 sf finished interior space  
  
Elevated exterior communal space: 400 sf

**Site:**  
Building orientation and minimal disruption of the existing landscape and vegetation were critical factors in the design of site. With the goal of lightly touching the site, the scheme employs a non-conventional foundation allowing the landscape to have direct storm water recharge and natural drainage toward the site's raingardens.

**Community:**  
The homes surround a deck that provides handicapped access to each house as well as a communal area where residents gather.

The driveway was relocated along the side street. This will allow for a vegetated visual and noise buffer, provide greater separation from Burts Pit Road, and will reduce the overall impervious surface on the site.

**Structure & Fabrication:**  
The design pairs an elevated pier structural system that supports a continuous uninterrupted 14" envelope structure. The fabrication of the envelope would occur offsite in a controlled environment which will promote precision in the component assembly, streamline construction time as the envelope fabrication could happen simultaneously to the site and foundation work and ultimately minimize the amount of time when the structure would be exposed to the elements. Final segments of the envelope would be trucked to the site and positioned by the construction team.

**Materials:**  
While plywood is an engineered sheet material that has conventionally been manufactured with harmful adhesives and fire-resistance chemicals including formaldehyde, recent initiatives have persuaded manufacturers to develop formaldehyde-free soy-based plywood that uses recycled wood that encourages the development of second life materials reducing the use of virgin wood.

Elevating the structure on piers helps eliminate the over-use of concrete.

The re-configuration of the communal driveway reduces the amount of impervious surface introduced to the site.

**Performance:**  
The design of the structural envelope provides a continuous 14" insulation cavity that would receive dense pack cellulose achieving an overall R-value of 50. The envelope is elevated, supported by structural piers providing an uninterrupted thermal envelope as well as minimizing the amount of site work and concrete used for the project promoting the efficient use of building materials.

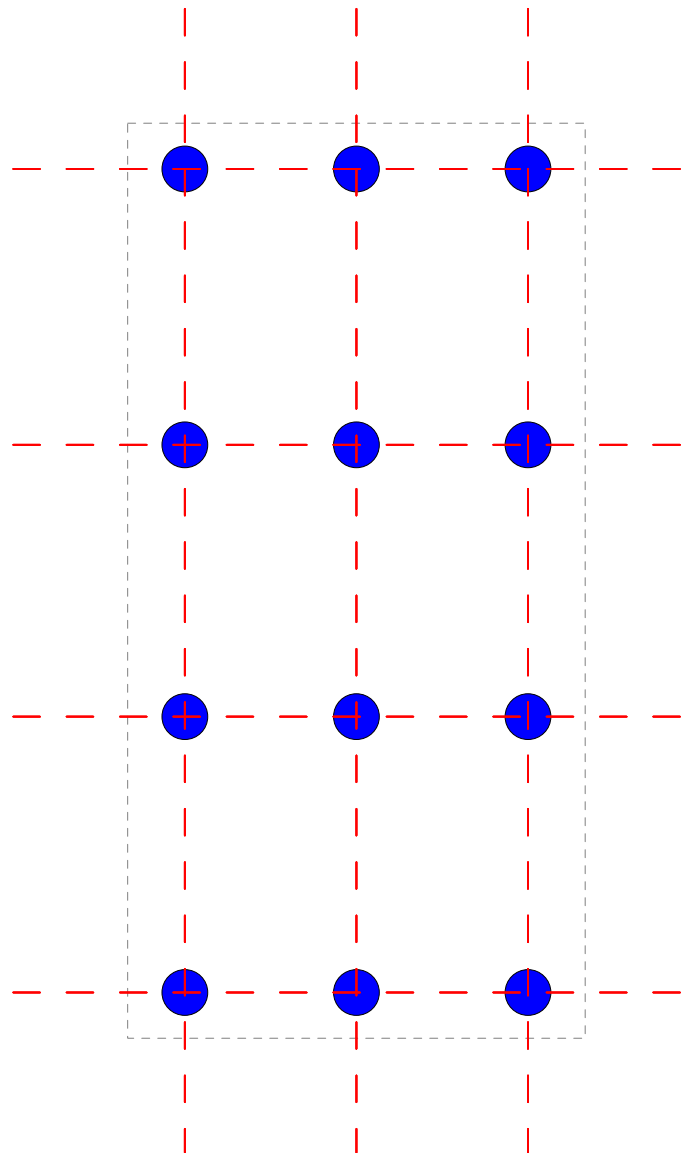
In addition to the high-performance envelope the buildings are sited to employ passive strategies for heating, cooling and air circulation. The design introduces a solar array positioned on the single-pitch south facing single bedroom structure located at the center of the development that supports a 10kW solar array providing supplemental energy to the three units.

The performance of the design stresses minimizing the window to wall ratio on all elevations:

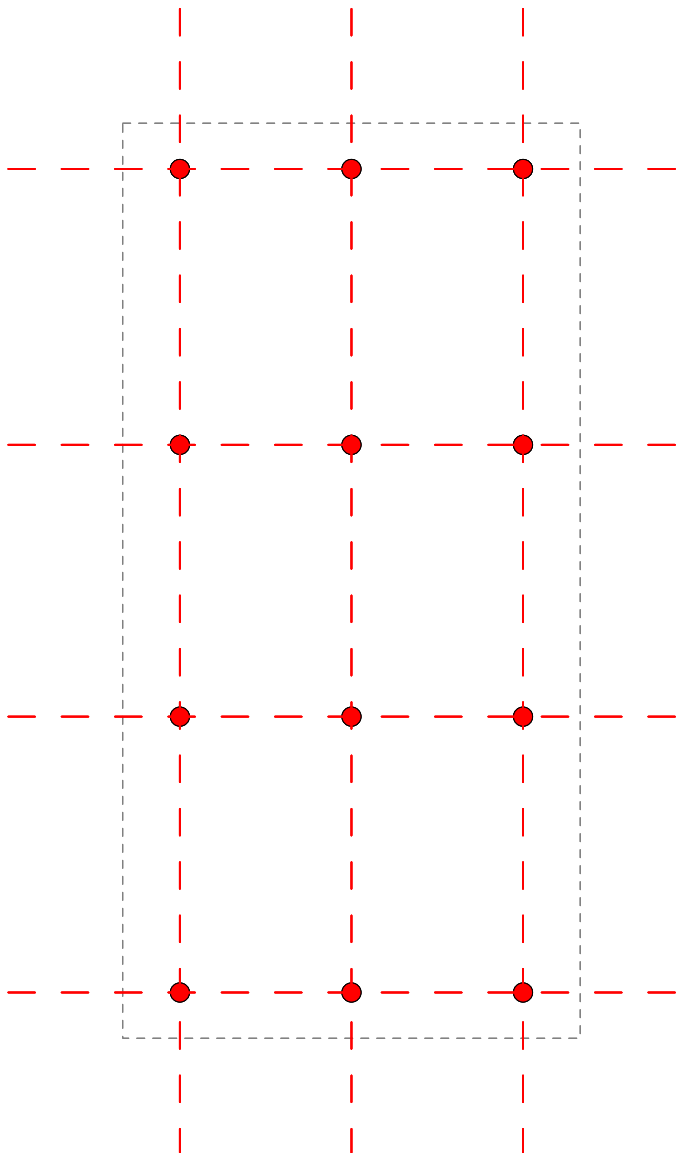
Window to Wall Ratio  
1 bedroom unit  
[North 0:360 = 0, South 71:240 = .29, East 63:200 = .31, West 24:200 = .12]  
  
2 bedroom unit  
[North 32:200 = .16, South 56:200 = .28, East 29:480 = .06, West 0:320 = 0]  
  
3 bedroom unit  
[North 32:300 = .10, South 72:300 = .24, East 0:480 = 0, West 0:320 = 0]

**Cost:**  
While the upfront cost for this proposal is slightly higher than a relatively high performing conventional framed structure that would meet Stretch Code standards the decision was made early on to maximize the overall performance of the structure as an overall method to substantially reduce the operational costs for the development overtime. The savings in energy costs attributed to heating and cooling will ultimately pay for itself overtime. A more in-depth cost comparison can be seen on board 2. The design is also intended to employ a construction methodology that becomes more cost effective with increased production.

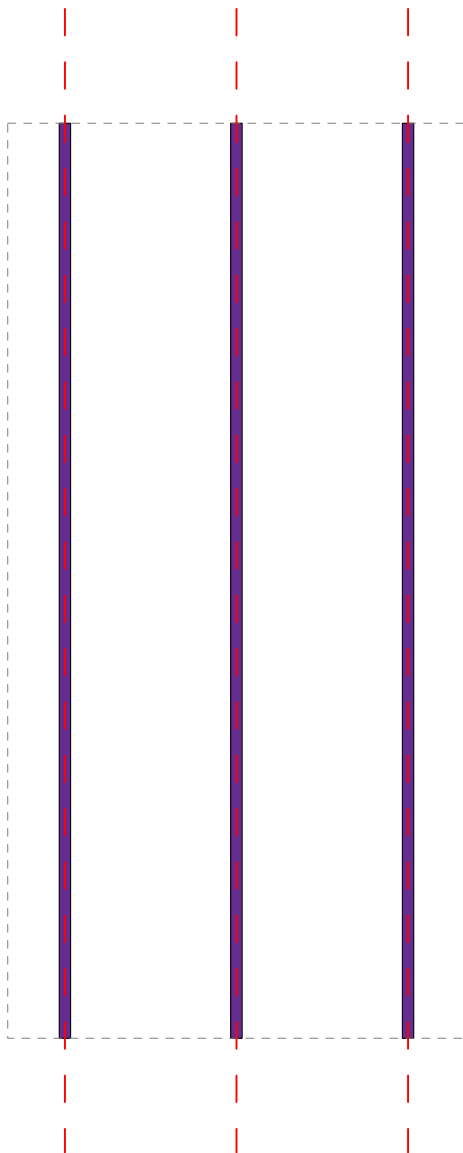
Fabrication & Assembly 1/4" = 1'-0"



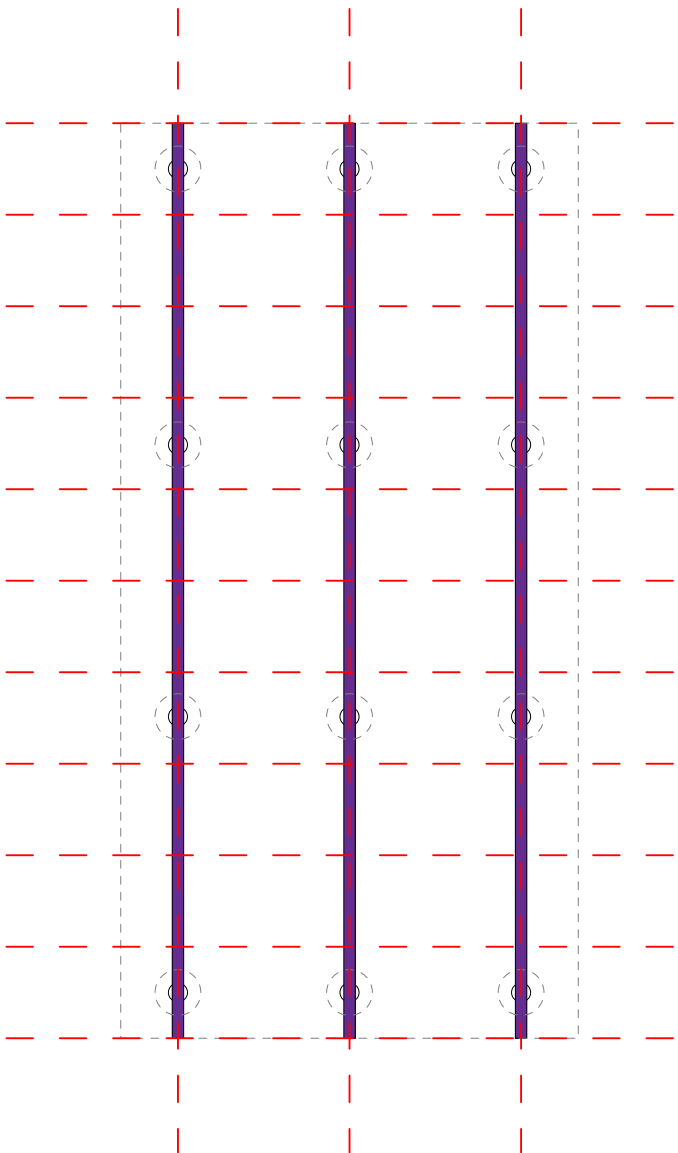
01. Footing Layout



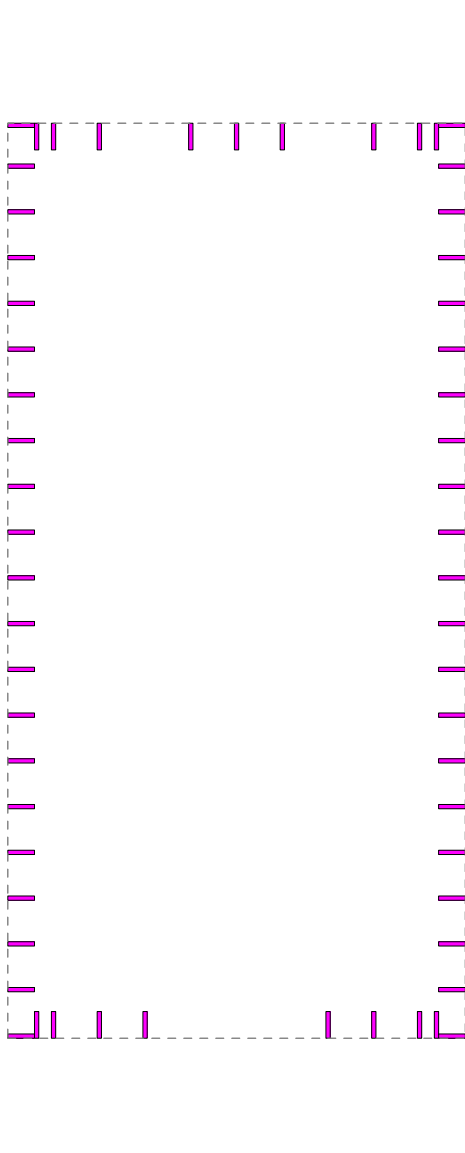
02. Pier Layout



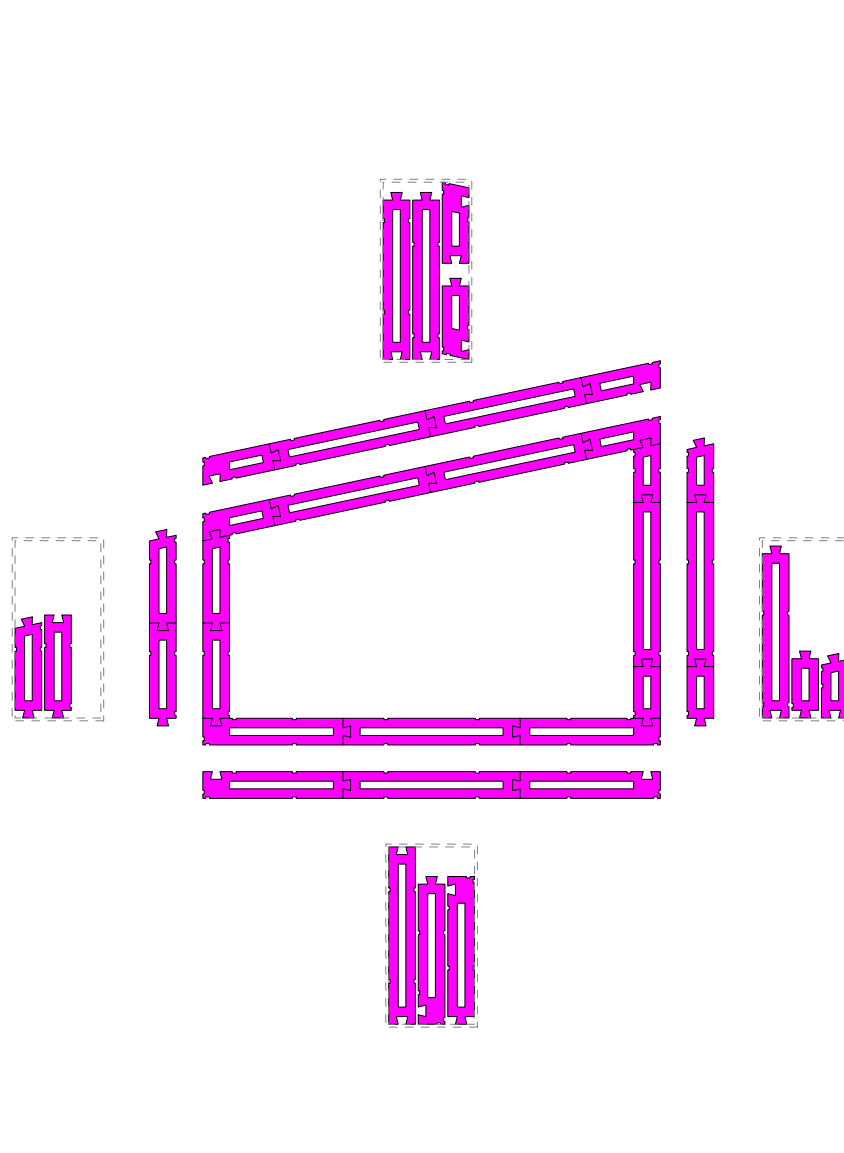
03. Beam Layout



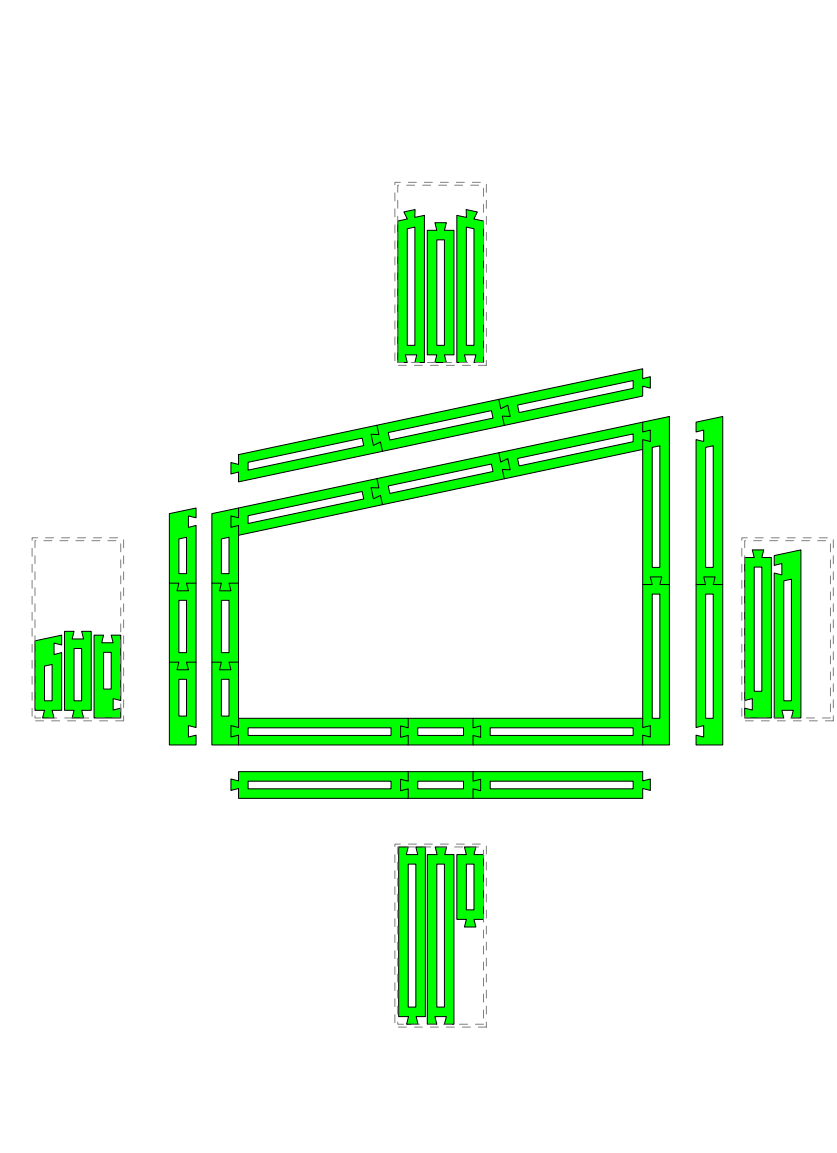
04. Base Structural Layout



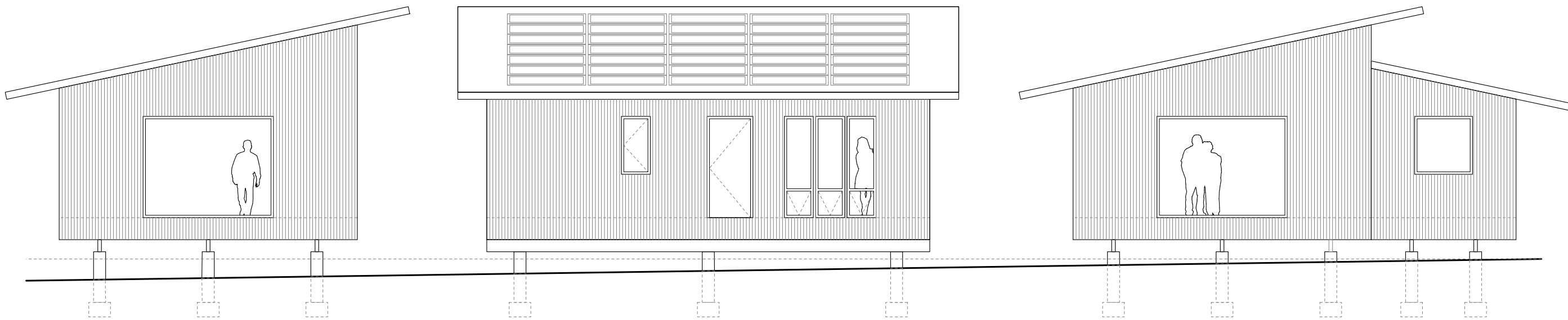
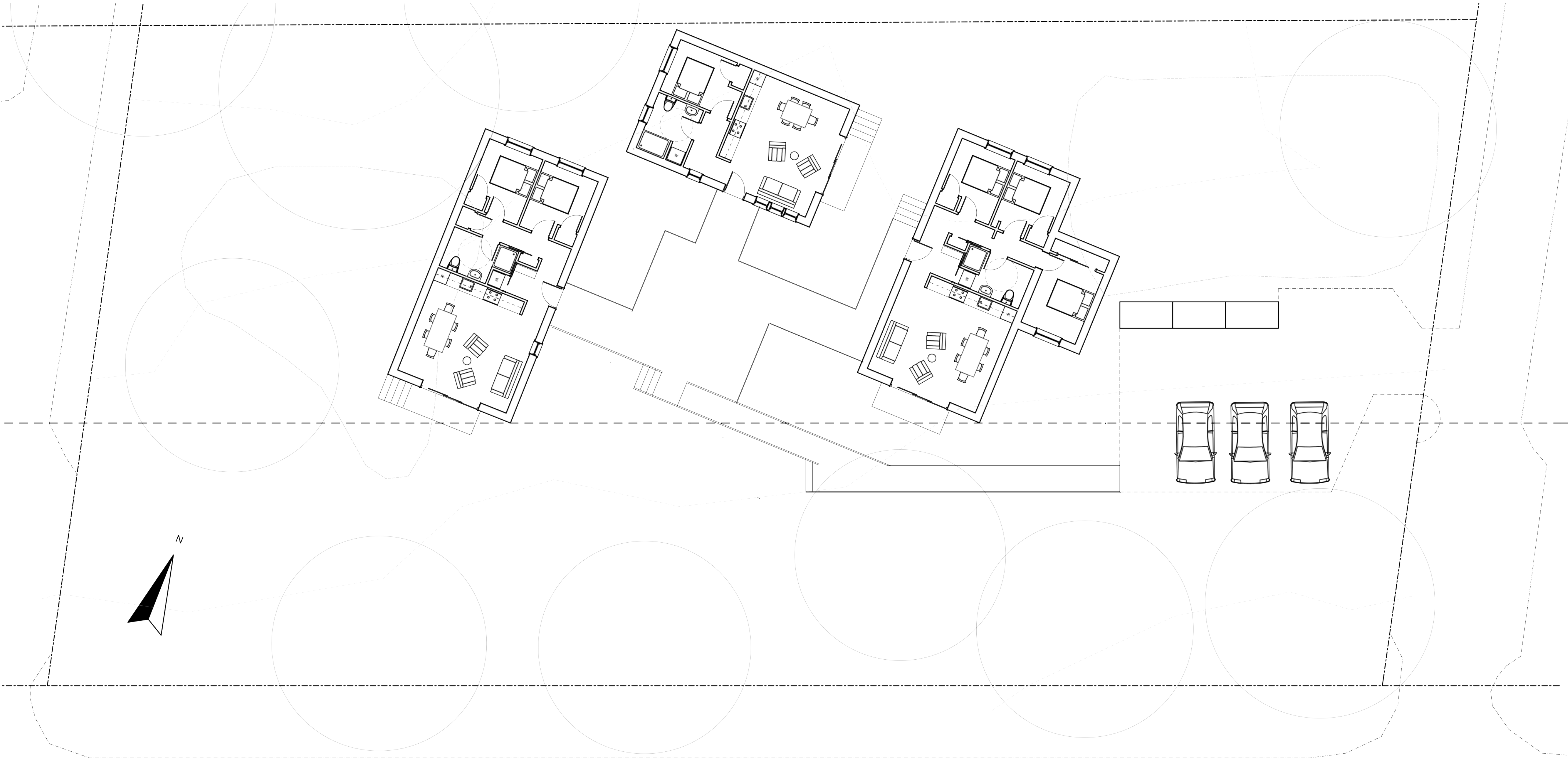
05. Envelope Structural Layout



06. Envelope Structural Unit A



07. Envelope Structural Unit B

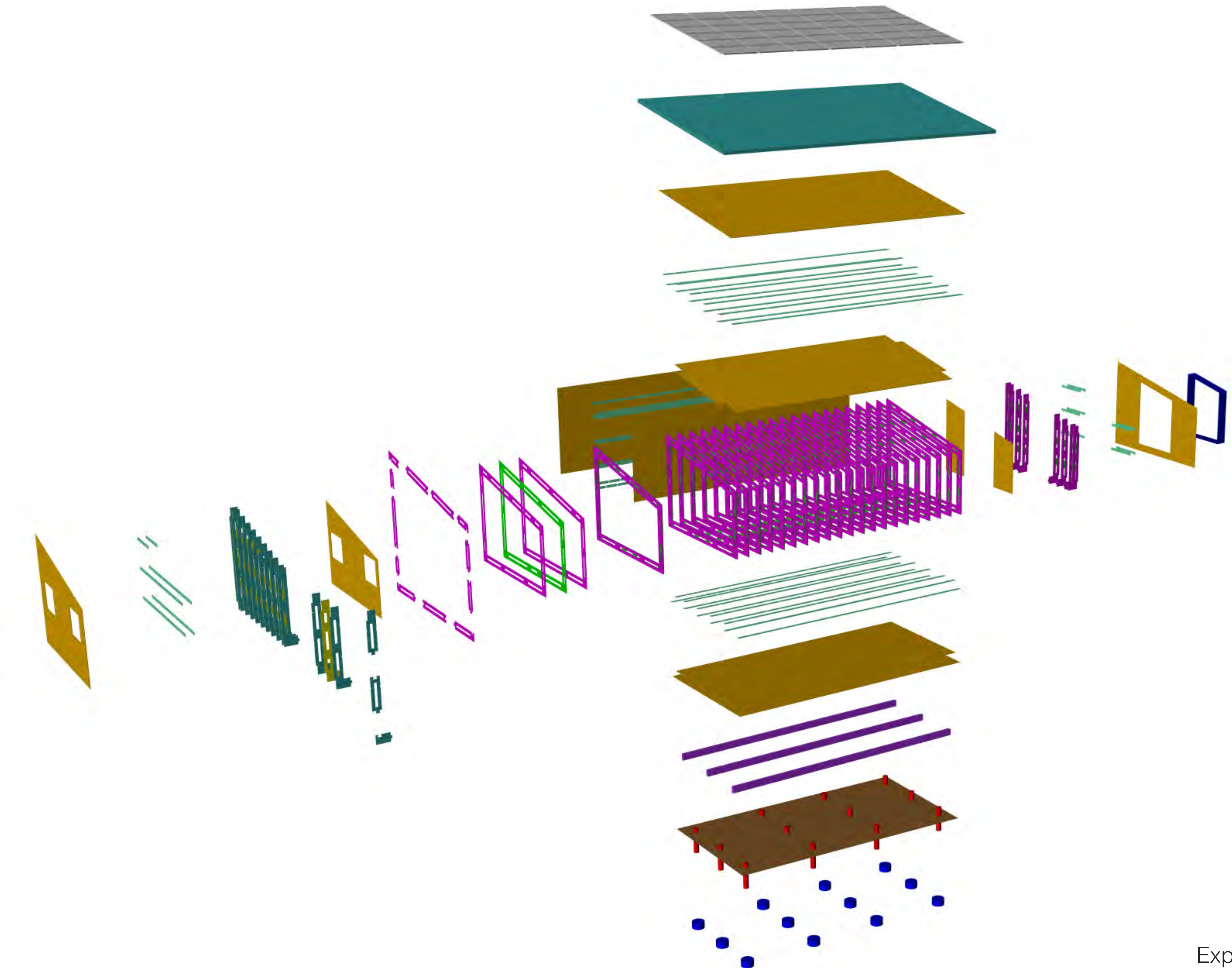


Site Elevation 1/4" = 1'-0"

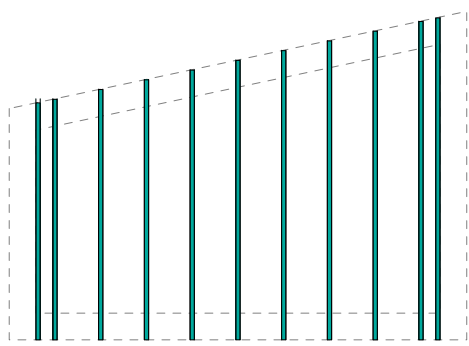


Material Cost Metrics

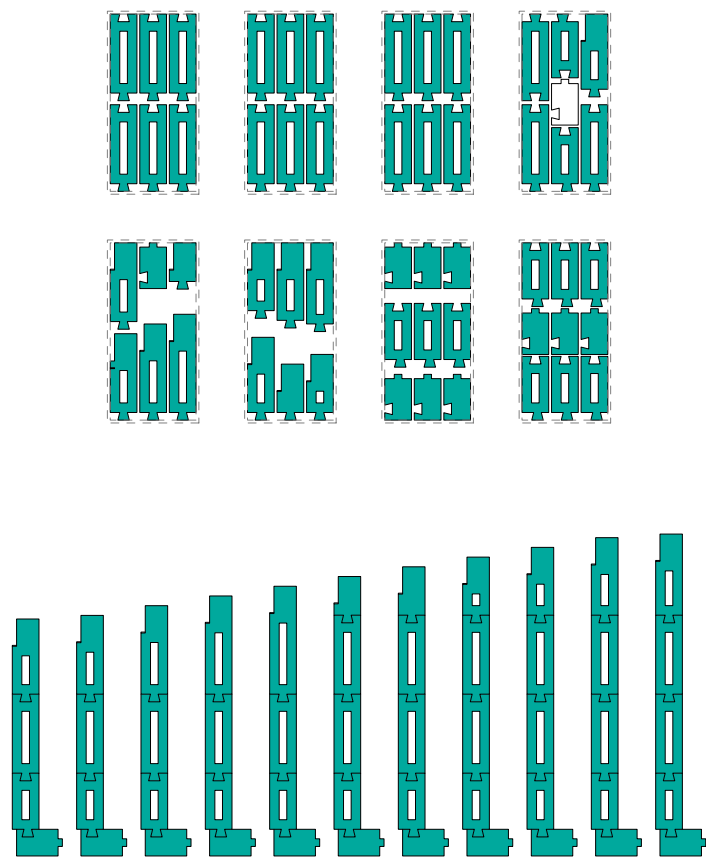
Conventional Framing (2x6 @ 16" O.C.)					Proposed Structure (14" Cont. Envelope @ 24" O.C.)				
Concrete		Cubic Yards	Unit Cost	Cost	Concrete		Cubic Yards	Units Cost / yrd	Cost
	Slab on Grade					Footings (3'X1')	3	\$90.00	\$270.00
	800 sf x 6" = 400 cu.ft	15	\$90.00	\$1,350.00		7 ft^3 x 12			
	Stem Wall	18	\$90.00	\$1,620.00		Piers (10"X4')	1.5	\$90.00	\$135.00
	120 lf x 4' x 1'					26 cu.ft x 12			
	Footing					Girders (1 3/4" X12'X20')	6	\$100.00	\$600.00
	120 lf x 2' x 1'	9	\$90.00	\$810.00					
Structure		# of Units	Unit Cost	Cost			Units	Unit Cost	Cost
	Walls					Envelope Structure			
	Short Walls (2'x6'x8')	27	\$5.00	\$135.00		Envelope (plywood)	250	\$20.00	\$5,000.00
	High Wall (2'x6'x12')	27	\$7.50	\$202.50		Spacers (plywood)	35	\$20.00	\$700.00
	End Wall (2'x6'x10')	28	\$6.00	\$168.00					
	Plates (360 lf)	45	\$5.00	\$225.00		Sheathing (plywood)			
	Floor Joists (1' TGI)	27	\$25.00	\$675.00		Roof	25	\$20.00	\$500.00
	Roof Joists (1' TGI)	27	\$25.00	\$675.00		Subfloor	25	\$20.00	\$500.00
	Headers, Sills, Jack Studs (150lf)	20	\$5.00	\$100.00		Short Wall	15	\$20.00	\$300.00
	(6 Windows)					High Wall	20	\$20.00	\$400.00
						Ends (x2)	15	\$20.00	\$300.00
	Sheathing					Interior Finish (plywood)	95	\$20.00	\$1,900.00
	Roof	25	\$6.00	\$150.00		Insulation (Dense Pack Cellulose)			
	Subfloor	25	\$6.00	\$150.00		Envelope (R50) (14in x 3,100sf)	3,600	\$1.75	\$6,300.00
	Short Wall	15	\$6.00	\$90.00		Envelope (R50)			
	High Wall	20	\$6.00	\$120.00		House Wrap (3,100 sf)	3	\$150.00	\$450.00
	Ends (x2)	15	\$6.00	\$90.00					
	Interior Finish: Drywall (4'X8'X1/2")	75	\$10.00	\$750.00					
	Insulation								
	Rigid EPS Under Slab (R10) (4inX800sf)	25	\$60.00	\$1,500.00					
	Slab (R10)								
	Walls, Dense Pack Cellulose (R22) (5.5in X 1,500sf)	750	\$1.75	\$1,312.50					
	Walls, Rigid EPS (R9) (2inX1,500)	50	\$30.00	\$1,500.00					
	Walls (R31)								
	Roof, Dense Pack Cellulose (R40) (1ftx 820sf)	820	\$1.75	\$1,435.00					
	Roof (R40)								
	House Wrap (2,300 sf)	2	\$150.00	\$300.00					
				Total: \$17,355.00					



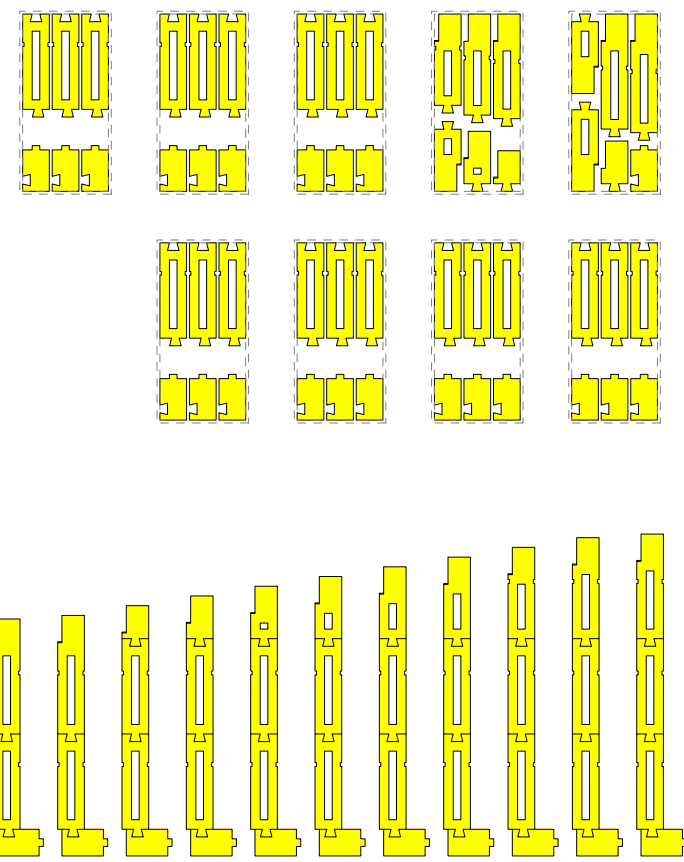
Exploded Axon



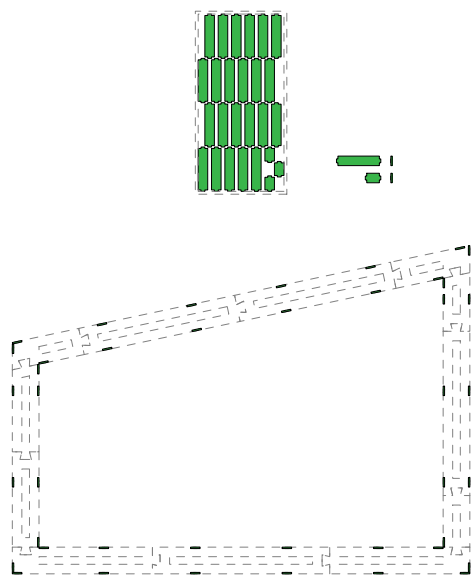
08. Envelope Structural Layout



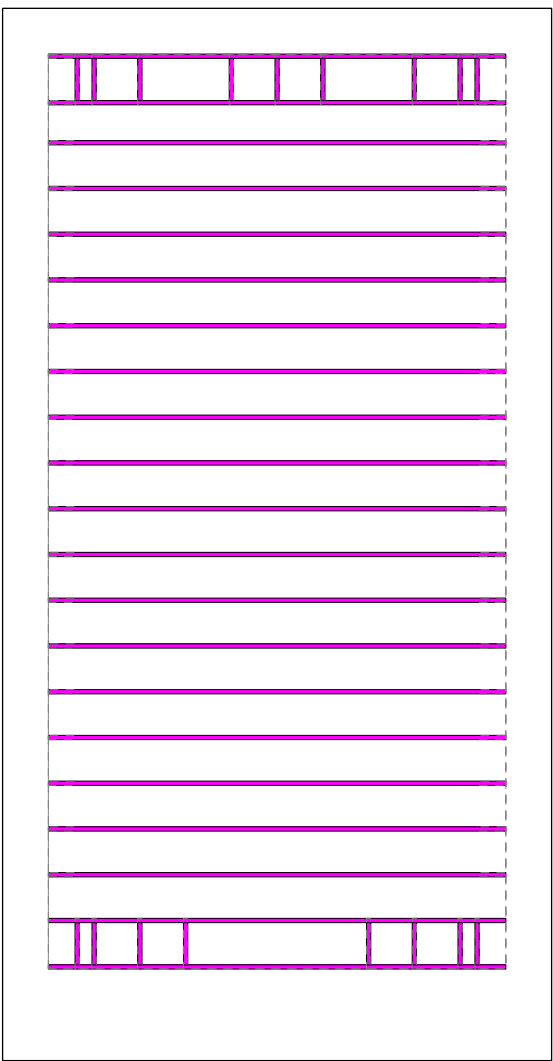
09. Envelope Structural Unit C



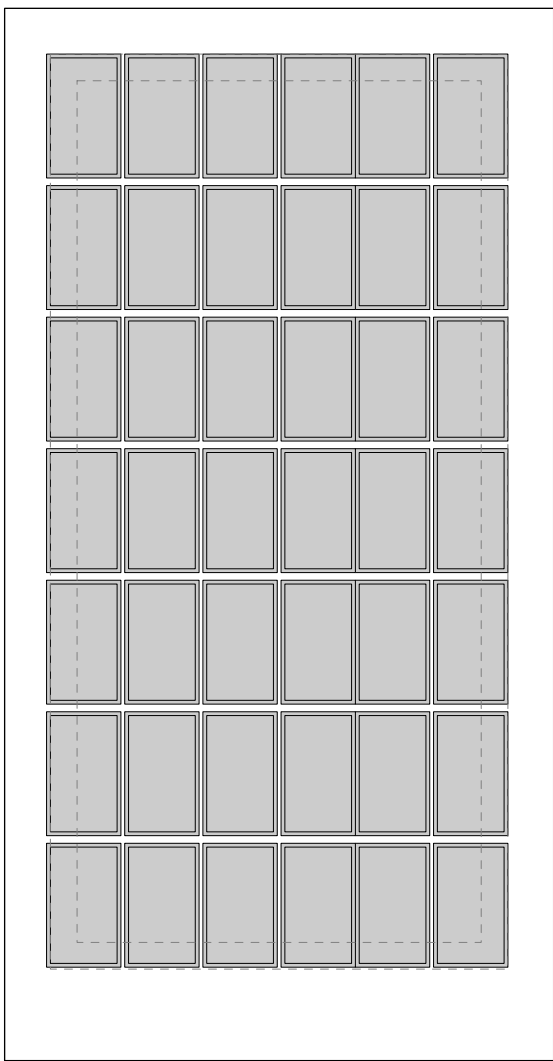
10. Envelope Structural Unit D



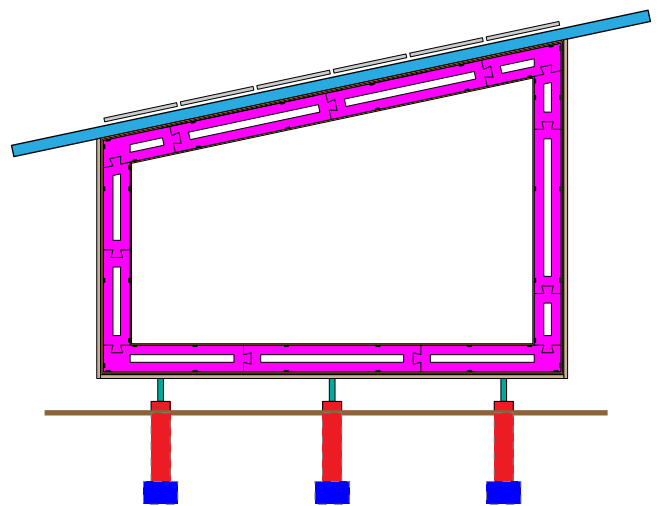
11. Envelope Structural Unit E



12. Envelope Structural Layout



13. Solar Array Layout



14. Envelope & Structural Cross Section